data." In the description of the pedigree the first sister is stated to be "certainly epileptic," the second merely "shows signs of epilepsy," while in Table I. both are definitely entered as epileptic. Yet these different statements occur in one and the same study of inheritance in epilepsy.

(*b*) Dr. Davenport writes that,

> Second, Dr. Heron catalogues with infinite pains, "errors" in citing the case numbers. Here he has fallen into a trap which the authors unconsciously prepared for him. To avoid the possibility that a person who is not authorized should connect an individual at the institution with his family history it was decided to apply alterations to the case numbers which enable the authors, but not the ordinary reader, to identify the case.

My criticism was summed up as follows:

> Tables A, C and D (of Drs. Davenport and Week's paper) thus contain particulars regarding the relatives of 74 normal parents. In only 30 cases do the entries agree with the tables from which they are supposed to have been extracted, or with the pedigrees given in the paper. In 13 cases out of 74 the case numbers do not agree, while 9 cases which ought to have appeared in Tables C and D have been omitted.

The whole of the errors made were definitely cited by me and the following may be given as examples. Case No. 4529 of Table IV. appears as No. 4521 in Table A *of the same paper* and No. 2124 as No. 2129. Comparing Tables VI. and C we find that No. 335 appears as No. 332, 481 as 483, $\left.\begin{matrix}504\\3781\end{matrix}\right\}$ b as $\left.\begin{matrix}503\\3781\end{matrix}\right\}$ b, 1705 as 1704, etc. Yet Dr. Davenport now states that these changes were deliberately made by him to hide the identity of the individuals dealt with. I am quite unable to understand how any individual can be identified as No. 4529 and yet escape identification as No. 4521. Perhaps Dr. Davenport will also explain how a pedigree came to appear in Bulletin No. 4, Table VII. as No. 2983, only to be changed in Table D of the same paper to No. 2984, to reappear at the Eugenics Congress as No. 2983 in Table VII. and to return to No. 2984 in Table C.

(*c*) Dr. Davenport states that I overlooked the fact that the details of his pedigrees were sometimes entered in 5 columns and sometimes in 9, 10 or 11 columns (not only in 10 as he states). I was well aware of the fact and made no objection to this procedure since in most cases Dr. Davenport has made up the deficiencies of his "5-column" classification by a long series of footnotes. I did object, however—to cite only a single example—when I found in case 2487 that there were four different versions of the mental condition of a single fraternity of 12 children and pointed out that Dr. Davenport gave of those who died early 0 or 2, of the "unknown" 0, 1 or 6, of the insane 0 or 1, of the neurotic 0, 3, 4 or 5, and of the alcoholic 1 or 2, according to the page consulted. It is for Dr. Davenport to justify these differences.

Finally I would ask those who wish to judge between Dr. Davenport and myself to read my memoir in conjunction with those of Dr. Davenport which I have criticized. They will then be able to judge for themselves whether or not my criticisms are justified. They involved far more serious matters than those to which Dr. Davenport now endeavors to reply.

DAVID HERON
THE FRANCIS GALTON EUGENICS LABORATORY,
UNIVERSITY OF LONDON

SCIENTIFIC BOOKS

Researches in Physical Optics with Especial Reference to the Radiation of Electrons. Part I. By R. W. WOOD. Columbia University Press (New York, 1913). Pp. 133, plates 10.

This volume, whose subtitle serves to illustrate the manner in which the electron is dominating current thought in physics, is the most recent number of the Ernest Kempton Adams Series. Of the eleven papers which are here collected all are experimental in character: a large number of the results have already been announced in other places, mainly in the last three or four volumes of the *Philosophical Magazine*.

In point of importance, the first two of these essays, dealing with the truly remarkable phe-

nomena found in the resonance spectra of iodine vapor—phenomena discovered by the author—ought probably to rank highest. The fundamental fact in regard to resonance spectra, namely, that a vapor when illuminated by monochromatic light which comes from a single direction will become self-luminous and will reemit light of the same wave-length in all directions, would appear to put this phenomenon into a category entirely different from that of ordinary fluorescence and to make it extremely worthy of investigation.

The first paper deals with the advantages which came from the use of iodine vapor in place of sodium vapor, and with the structure of the absorption spectrum of iodine, which with Wood's forty-foot spectrograph shows no less than seven lines within the space occupied by the green mercury line alone. Here also is described the curious and unexplained effect of mixing helium with the iodine vapor, namely, the transformation of resonance spectra into banded spectra. Another unexplained phenomenon in this connection is the fact that when the exciting beam of light is polarized this polarization is passed on to the lines of the resonance spectra.

The second paper describes the 40-foot spectrograph with its now celebrated "pussy-cat" attachment and also deals with the absorption spectra of iodine and the emission spectrum of mercury. Wood estimates the number of absorption lines in iodine vapor at 50,000, and recommends it as superior to sunlight for testing large gratings. Important extensions of this work on iodine vapor are reported in the current (November) number of the *Philosophical Magazine.*

The third paper deals with the resonance spectrum of another vapor—that of mercury—which is excited only by ultra-violet light of wave-length 2536. Here is related the discovery of "secondary" resonance, a remarkable radiation, which comes, not from the vapor directly illuminated by the exciting ray, but from those portions of the vapor which are illuminated only by primary resonance radiation. A most interesting feature of this paper is the experimental passage from diffuse to regular reflection of resonating vapor, *i. e.,* from volume to surface reflection. Experiments show that the resonance radiation "begins to weaken at a pressure of about 2 cm. (mercury vapor) and is practically gone at 70 cm."

Next follows a not very successful attempt to determine the anomalous dispersion of mercury vapor in the neighborhood of λ 2536, by use of Puccianti's method. Among the most interesting results in these papers must be reckoned those in which Professor Wood has determined, by experiment, the connection between transparency of a layer of metallic globules and the diameter of those spheres. Using a layer of mercury droplets deposited as "dew" on a quartz plate and examining them for transparency by use of infra-red rays of wave-length 112 μ he finds that these metallic particles have no effect in stopping long heat waves until their diameter begins to exceed one tenth of a wave-length. Very striking also is the fact that such a sheet of small metallic particles—packed together in such a way that they almost touch—seems not at all to interfere with the transparency of those portions of the plate not covered by the metal; the plate remains as transparent for waves of 112 μ as for waves of 1 μ.

Paper No. 6, dealing with diffraction gratings having a controlled groove-form, does not quite reach the level of those which precede it. The next contribution contains some excellent photographic examples of the reflective power of nickel films on glass and numerous details concerning the author's method of depositing these films.

Paper No. 8 carries the title of "Selective Absorption of Light on the Moon's Surface and Lunar Petrography," the latter half of which impresses one as rather ambitious. "Petrography" is a word which has too definite a meaning to be employed as a description of local differences of color either on the moon or on any other body. The method employed is that of using different ray-filters for photographing the moon with light from three regions in the spectrum; and then combining the three negatives into a three-color

picture. The silvering process was evidently described during a moment of relaxation when the author's characteristic humor came to the surface as follows: "Personally I never weigh my nitrate of silver, as I enjoy the element of the personal equation which enters the problem when scales are dispensed with." How seriously this is to be taken may be judged from one or two of his immediately following sentences. "From one to two grams to 100 c.c. of distilled water is about right." "Unfortunately things as described above seldom happen at the first trial." "It troubled me much when my personal equation contained one more variable than at present, but I have not seen it occur recently. As the production of the uniform blue film depends upon getting the proportions just right, I suppose the beginner had better mix measured amounts for each trial unless he has access to a large jar of silver nitrate which 'belongs to the department.'" "The cause of this I do not know. Probably it is osmotic or perhaps catalytic!"

The results contained in the next paper, entitled, "Note on the electron atmospheres of metals," are capable of a quite different and less significant interpretation than that given by the author, as has already been pointed out by several other investigators.

The resolution of the four principal mercury lines, by a five-inch plane grating, ruled by Anderson at Baltimore, is discussed in Paper No. 10, and speaks well for the high quality of the grating.

The eleventh paper concludes the series with an interesting explanation and experimental verification of the "Imprisonment of Radiations by Total Reflection."

Of the volume as a whole, one hardly knows whether to admire more the boldness of ideas which prompt the experiments or the manipulative skill with which they are executed.

HENRY CREW
NORTHWESTERN UNIVERSITY

Astronomy: A Popular Handbook. By HAROLD JACOBY, Rutherford Professor of Astronomy in Columbia University. The Macmillan Company, New York. 1913.

Most astronomers yield at one time or another to the desire to write some popular treatise on astronomy. Professor Jacoby has prepared his volume in the effort "to meet the wishes of the ordinary reader who may desire to inform himself as to the present state of astronomical science, etc." The book is intended also to serve for use in high schools and colleges. To meet this double end, the author has placed all the mathematical notes and explanations in the appendix, where they are at the service of students, while the main body of the text is free from mathematics, which might discourage the "ordinary reader." This method of arrangement is not unusual, but the author has carried it out more systematically than is usually done.

Professor Jacoby's treatment of the subject is distinctly out of the ordinary, and it is this originality of method and style which may well furnish the *raison d' être* for this addition to our astronomical literature. The first chapter is in the form of a general survey of the universe, a prelude to the detailed descriptions which follow. In the third chapter methods are given for finding the planets and stars. This chapter, however interesting for other reasons or valuable for intellectual training, does not impress one as containing the simplest methods for gaining familiarity with the stars and planets. Monthly maps are now published giving the appearance and positions of planets and comets as well as the stars, and it is doubtful if any verbal description, tables and small diagrams can compare in efficiency with such maps in assisting an ordinary reader to the identification of celestial objects. The author, however, would doubtless encourage the use of such maps in connection with the reading of the book. Chapter V. gives a brief but admirable discussion of the sun dial with a description of the manner in which one may be constructed by the reader. The earth and its relationships are handled in an original and interesting way. Under "Moonshine" the author presents the leading facts about our satellite, giving the usual proof of the absence of an atmosphere and the probable cause of its disappearance. No reference is made to the